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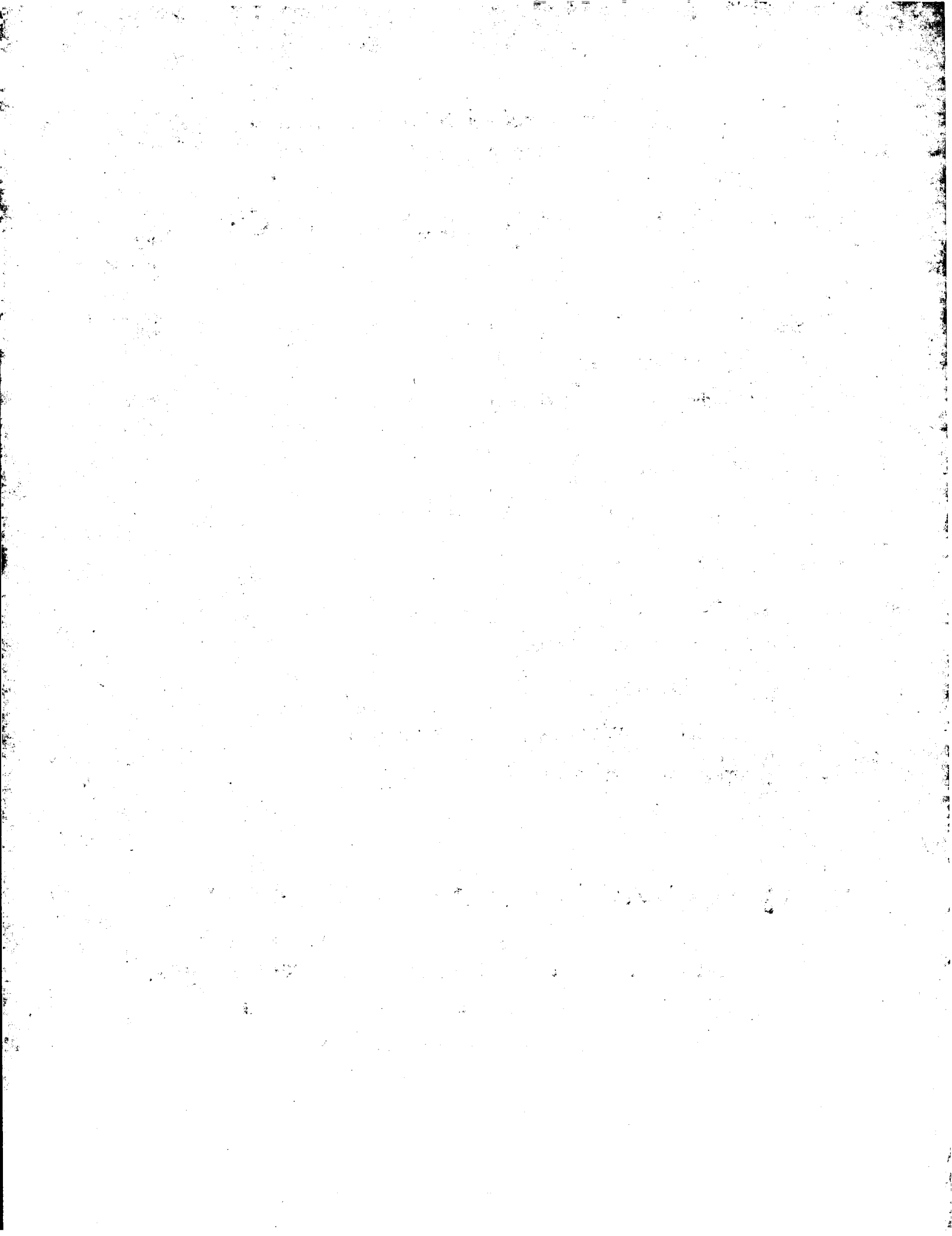
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## Gastight folding door and method for the installation thereof

The invention relates to a gastight door provided with a number of lying panels pivotably connected to one another, at least some of which panels are provided at their  
5 ends with guide elements which are movable in guide sections arranged on either side of an opening to be closed by the door, at least the bottom panel being connected to a lifting device and at least one sealing section extending around the periphery of the door opening. Doors of this type are known and have already been marketed by the Applicant for some considerable time, in particular for use for gastight closure of  
10 ripening rooms for fruit, such as, for example, bananas, cold rooms and the like.

To date sliding doors are generally used for this type of application, which sliding doors are installed outside the room to be closed off and the ends of which doors move between closely abutting sealing strips. As the side of the door facing the room to be closed off must be flat in order to produce a good seal, the hinge connections between  
15 the panels making up the door are mounted on the side facing away from the room, with the result that the top of the sliding door will execute a movement directed away from the room. Consequently, a relatively large area on the outside of the room to be closed off is required for accommodating the sliding door in its open position.

However, when building storage facilities with gastight rooms the aim is, to an increasing extent, to minimise the area between rooms which, after all, constitutes  
20 unused space, and to increase the capacity of the storage rooms or cold rooms to an ever greater extent, whilst, at the same time, increasing the size of the door opening. Consequently, accommodation of the sliding door in its open position is constituting an ever greater problem. The aim of the invention is, therefore, to provide a door of the  
25 type described above with which said problem no longer arises. This is achieved according to the invention in that the panels are pivotable alternately in opposing directions and the sealing section is inflatable. In this way a gastight folding door is obtained which takes up relatively little room in the opened position.

Preferred embodiments of the gastight folding door according to the invention are  
30 described in the sub-claims.

A further aim of the invention is to provide a method for the installation of a folding door of the type described above, with which method the installation time and cost can be limited as far as possible. This is important in view of the fact that doors of

this type are frequently used in the vicinity of the location where the products to be stored are harvested and, especially in countries where tropical fruits are cultivated and where there is thus a great need for storage rooms of this type, there are frequently insufficient numbers of trained personnel available. For this purpose, the invention

5 provides a method for the installation of a folding door, with which method the door panels, the lifting device and the Y-shaped part of the guide sections are assembled in a central location to produce a transportable unit, the unit produced in this way is transported to the building in which the door has to be installed and the unit is mounted on site above a door opening, after which straight guide sections are fitted which link

10 the unit to the ground. The complex assembly operations can thus be carried out by trained personnel in a factory and installers on site merely have to mount the already complete door installation and to fit the bottom, straight sections of the guide section.

The invention will now be explained with the aid of an example, with reference to the appended drawing, in which:

15 Fig. 1 shows a partially exposed perspective view of a gastight folding door according to the invention in the closed position;

Fig. 2 shows a partially exposed perspective detailed view along the arrow II in Fig. 1, which shows the door in the open position;

Fig. 3 shows a partially exposed perspective detailed view of the emergency brake

20 for the door;

Fig. 4 shows a partially exposed perspective detailed view along the arrow IV in Fig. 1; and

Fig. 5 shows a shortened cross-section through a panel of the door according to the invention.

25 A gastight folding door 1 (Fig. 1) comprises a number of lying panels 2, which are pivotably connected to one another by means of hinges 18. With this arrangement the hinges are fitted in such a way that the panels 2 are pivotable alternately in opposing directions. The door 1 closes an opening 5 to a room, for example a cold room or storage room, gastight. For this purpose a sealing section 12 which engages

30 with the door 1 is fitted around the periphery of the door opening 5. The hinges 18 fitted on that side of the door 1 facing away from the door opening 5 are fitted close to the sides of the door 1, whilst the hinges 18 facing towards the door opening have been moved towards the middle of the door so as not to interfere with the functioning of the

sealing section 12.

The door panels 2 are provided with guide elements 3, which are movable in guide sections 4 which are fitted on either side of the door opening 5. The bottom door panel 2 is connected via two chains 6 fitted on either side of the door 1 to a lifting device 7. Said lifting device 7 comprises a lifting shaft 10 which extends above the door opening 5, on which shaft two sprocket chain wheels 11 are mounted and which is rotatably mounted in two bearings 39. The lifting shaft 10 is driven via a right-angle transmission 25 by a motor 26 which is indicated by broken lines (Fig. 2).

By allowing the motor 26 to rotate in a first direction, the chains 6 are taken up over the sprocket chain wheels 11 and the bottom door panel 2 is moved upwards, as a result of which the panels 2 located above said bottom panel are also pushed upwards. The guide sections 4 define two guide tracks 8, 9 on either side of the door opening 5, which guide tracks are parallel over a large part of the height of the door opening 5 and diverge in a Y-shape at the top. As a result, when the door 1 is in the open position, the panels 2 come to lie horizontally, as is shown in Fig. 2. With this arrangement, the guide elements 3 ultimately run out of the fanned-out guide track 9 through an opening 56 therein.

In order to limit the load on the motor 26, a number of counterweights 17 are suspended on the free-hanging return part 16 of each chain 6. Said weights 17 jointly exert a force, the magnitude of which is approximately proportional to the weight of the door panels 2. Thus, the motor has to supply only the force required for movement. Since the apparent weight of the door 1 decreases every time a panel 2 has reached its horizontal end position, the counterweights 17 are of distributed construction and are fixed with mutual spacing to the chains 6. What is achieved by this means is that whenever a panel 2 reaches its horizontal position, one of the counterweights 17 comes to rest on the ground 40. This prevents the panels 2 being raised at increasing speed under the influence of an ever increasing weight "excess" of the counterweights 17 compared with the panels 2.

The guide elements 3 each comprise a bracket fixed to the associated door panel 2 and wheel 22 rotatably supported in bearings in said bracket. The bottom panel 2 is provided with a hinge pin 37, by means of which the panel is pivotably connected to a carriage 23, which is provided with two wheels 22. Said carriage 23 is of essentially L-shaped construction, such that the wheels 22 run in one of the guide tracks 8, 9

provided on a flat flange 13 of the guide section 4, whilst the end of the carriage 23 projects into a U-shaped part 14 of the guide section 4 (Fig. 3). The L-shaped carriage 23 forms the connection between the bottom door panel 2 and the lifting chain 6. An emergency brake mechanism 29 is mounted between the carriage 23 and the lifting chain 6, which emergency brake mechanism comprises an elongated friction body 30, which is pivotably connected about a spindle 31 to the L-shaped carriage 23, and on which the lifting chain 6 is mounted at the location of a connection point 32. The elongated body 30 is provided with teeth on one side and is held by the lifting force on the chain 6 with its longitudinal axis virtually parallel to the U-shaped part 14 of the guide section 4, as a result of which it is kept away from the walls of the U-shaped part 14. A fixing pin 33 is also fitted on the friction body 30, to which fixing pin a draw spring 34 is fixed, the other end of which is pushed over a lip 35 on the L-shaped carriage 23. When the lifting device 7 is in normal operation, the friction body 30 is kept away from the walls of the U-shaped part 14 of the guide section 4 by the lifting force in the chain 6, and the carriage 23, and therefore the door 1, can be moved freely up and down. However, if the tensile force in the chain 6 falls away, for example as a result of a break in the chain or something similar, the friction body 30 will be pulled, under the influence of the pretensioning force of the spring 34, into the position 30' shown by broken lines, as a result of which its serrated side and its opposing side will come into contact with the walls of the guide section 4, and the carriage 23, and thus the door 1, will brake and finally stop in a fixed position.

In order to prevent leaks between the door 1 and the door opening 5, a sealing section 12 is fitted around the door opening 5, which sealing section is able, when the door 1 is closed, to fill the gap between the face of the door 1 and the wall in which the door opening 5 has been made. For this purpose the sealing section 12 is inflatable. The section 12 is essentially mushroom-shaped in cross-section and has a relatively broad, hollow hose 41 (the "head") and an essentially U-shaped section part 42 (the "stalk" of the mushroom), which can be clamped around an I-section 43 fitted round the door opening 5 (Fig. 4). The sealing section 12 is connected to blowing and suction means in the form of a compressor 45 which is driven by a motor 46 and is connected via a line 44 to the hose section 41 of the section 12. Therefore, when the door 1 is moved into its closed position the compressor 45 can be operated by starting the motor 46, as a result of which air or some other gas is blown into the hose 41, with the result that the



sealing section 12 inflates and seals the gap between the door opening 5 and the door 1 gastight. At the bottom of the door 1, the sealing section 12 merges into a rubber contact part 47, which has a stop 55 protruding into the hose 41. The contact 47 is concave, whilst the bottom edge of the bottom door panel 2 is convex, as a result of which a good seal can be obtained in a simple manner. With this arrangement, the bottom edge 24 of the bottom door panel is constructed of a relatively soft, deformable material, such as, for example, rubber.

The door panels 2 themselves are made of an insulating core, for example a foam core 50, and a relatively thin skin 49, of, for example, plastic or lightweight metal, fitted around said core. The side edges of each door panel are closed off by a mounting section 51, to which the guide elements 3 can be fixed. Each panel 2 has a tongue 19 and a groove 20, as a result of which panels located above one another fit closely abutting one another when the door is in the closed position. Both the tongue 19 and the groove 20 are formed by a separate section, which has an open space 52 and 53 respectively, in which a soft sealing section can also be accommodated to provide a gastight seal between the panels 2 located above one another. Each panel 2 is provided, on its side facing the door opening 5, with a deformable sealing strip 54, which, at least when the door is in the closed position, protrudes beyond the face thereof and then presses against the sealing section 12. By making use of a sealing strip of readily deformable material, leak openings as a consequence of bevelling on the corners of the panels 2 can be completely precluded.

In order to be able to open and close the door 1 quickly, the compressor 45 is connected to the sealing section 12 in such a way that it is capable not only of blowing air into the section 12 but also of extracting air therefrom. As a result, the door can be opened quickly without an unnecessarily large degree of friction arising between the panels and the section 12.

The top part of the door 1, formed by the panels 2, the Y-shaped part of the guide sections 8, 9 and the lifting device 7 are constructed in such a way that they can be assembled in the factory to produce a unit which is relatively simple to transport. For this purpose, the guide sections 8, 9 are connected at their tops by cross-members 27, which, in turn, are connected by a member 38 which spans the door opening 5. Struts 28 are also fitted between the members 27 and the member 38. By assembling the door 1 virtually completely in the factory, the door can be installed easily at the destination

by mounting the prepared unit above the door opening 5 and local installers then have to fit only the straight parts of the guide sections 4 under the unit already installed. As a result on-site installation costs are substantially reduced and the risk of incorrect installation is also reduced.

- 5 The lifting installation 7 and the blowing/suction means 44, 45, 46 can be operated manually, but it is also conceivable that these functions are coupled in a programmable control unit. In this case the various actions required for opening or closing the door 1 can then be carried out in the correct sequence by a single press on a button.

## Claims

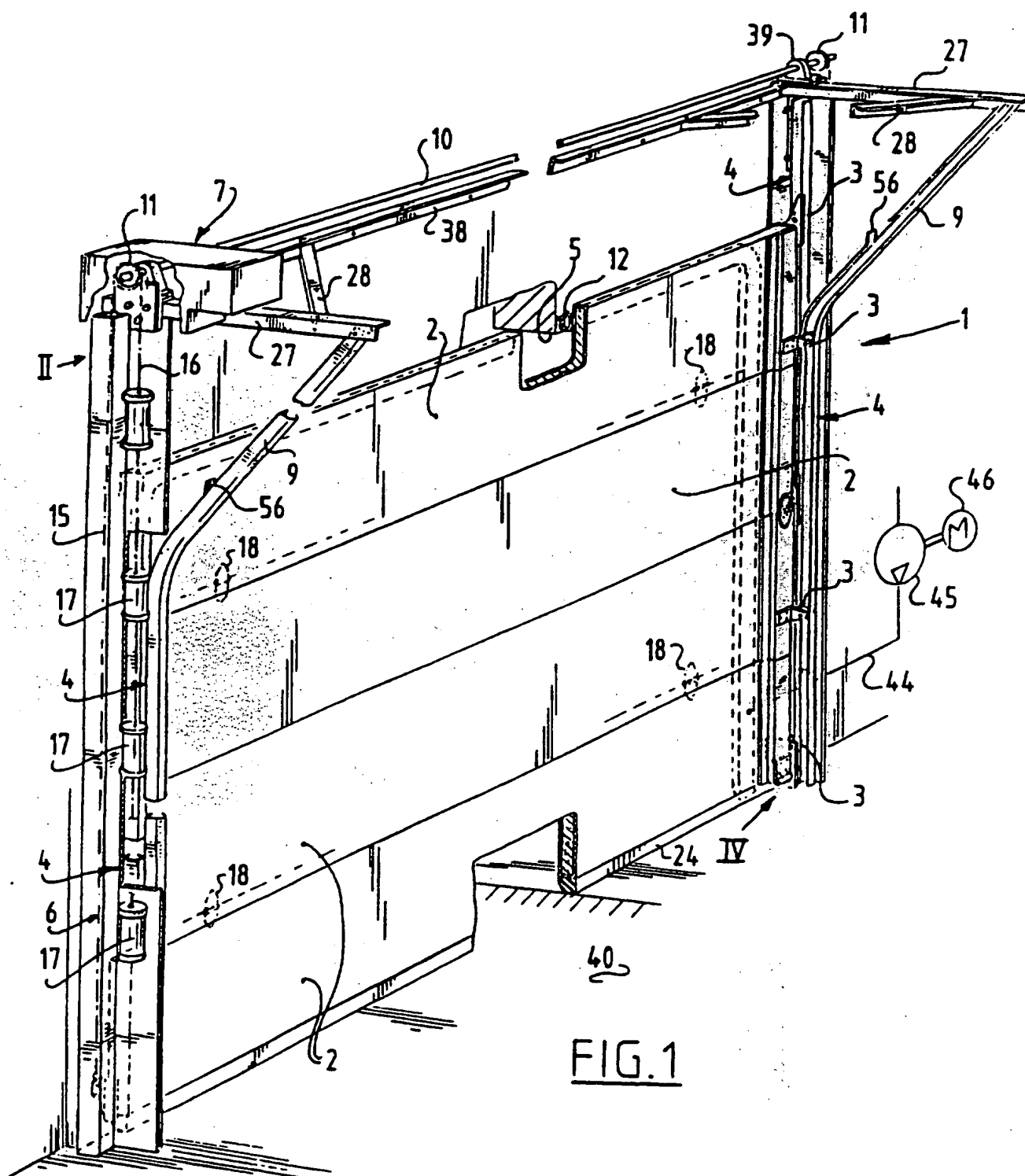
1. Gastight door (1) provided with a number of lying panels (2) pivotably connected to one another, at least some of which panels are provided at their ends with  
5 guide elements (3) which are movable in guide sections (4) arranged on either side of an opening (5) to be closed by the door (1), at least the bottom panel (2) being connected to a lifting device (7) and at least one sealing section (13) extending around the periphery of the door opening (5), characterised in that the panels (2) are pivotable alternately in opposing directions and the sealing section (12) is inflatable.
- 10 2. Gastight folding door (1) according to Claim 1, characterised in that the bottom panel (2) is connected to the lifting device (7) by at least one chain (6) accommodated in the guide section (4).
3. Gastight folding door (1) according to Claim 1 or 2, characterised in that each  
15 guide section (4) defines two essentially parallel guide tracks (8, 9) which diverge at the top into a Y-shape.
4. Gastight folding door (1) according to one of the preceding claims, characterised in that the chain (6) has a lifting part (15) connecting the panel (2) to the lifting device (7) and a return part (16) which hangs freely downwards, and a load  
20 which essentially compensates for the weight of the door panels (2) is exerted on the return part (16).
5. Gastight folding door (1) according to Claim 4, characterised in that a number of counterweights (17) are mounted, with a mutual spacing, on the return part (16).
6. Gastight folding door (1) according to one of the preceding claims, characterised by emergency braking means (29) connected to the chain (6).
- 25 7. Gastight folding door (1) according to Claim 6, characterised in that the emergency braking means (29) comprise at least one elongated friction element (30) accommodated in the guide section (4), connected to the chain (6) and consequently held away from the wall of the guide section (4).
8. Gastight folding door (1) according to one of the preceding claims,  
30 characterised in that the sealing section (12) is connected to blowing and suction means (44, 45, 46).
9. Gastight folding door (1) according to Claim 8, characterised in that the sealing section (12) has an essentially mushroom-shaped cross-section.

10. Gastight folding door (1) according to Claim 8 or 9, characterised by deformable sealing strips (54) mounted between adjacent panels (2) on that side of the door (1) which faces the sealing section (12) and protruding beyond the face of the door (1).

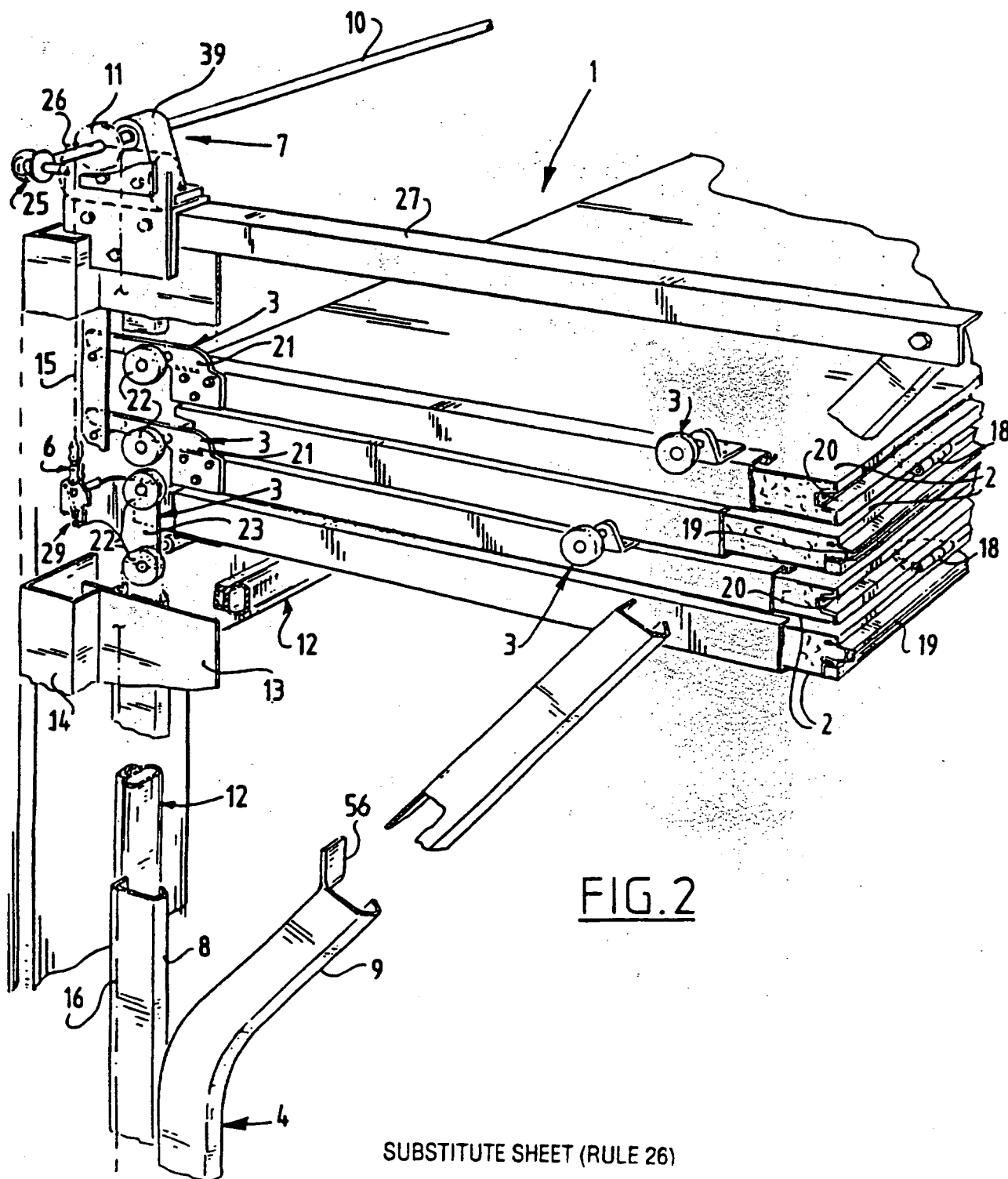
5 11. Gastight folding door (1) according to one of the preceding claims, characterised in that the panels (2), the lifting device (7) and the Y-shaped part of the guide sections (4) form a unit ready for installation.

10 12. Method for installing a gastight folding door (1) according to one of the preceding claims in a building by assembling the door panels (2), the lifting device (7) and the Y-shaped part of the guide sections (4) in a central location to produce a transportable unit, transporting the unit thus produced to the building, mounting the unit on site above a door opening (5) and fitting straight guide sections connecting the unit to the ground (40).

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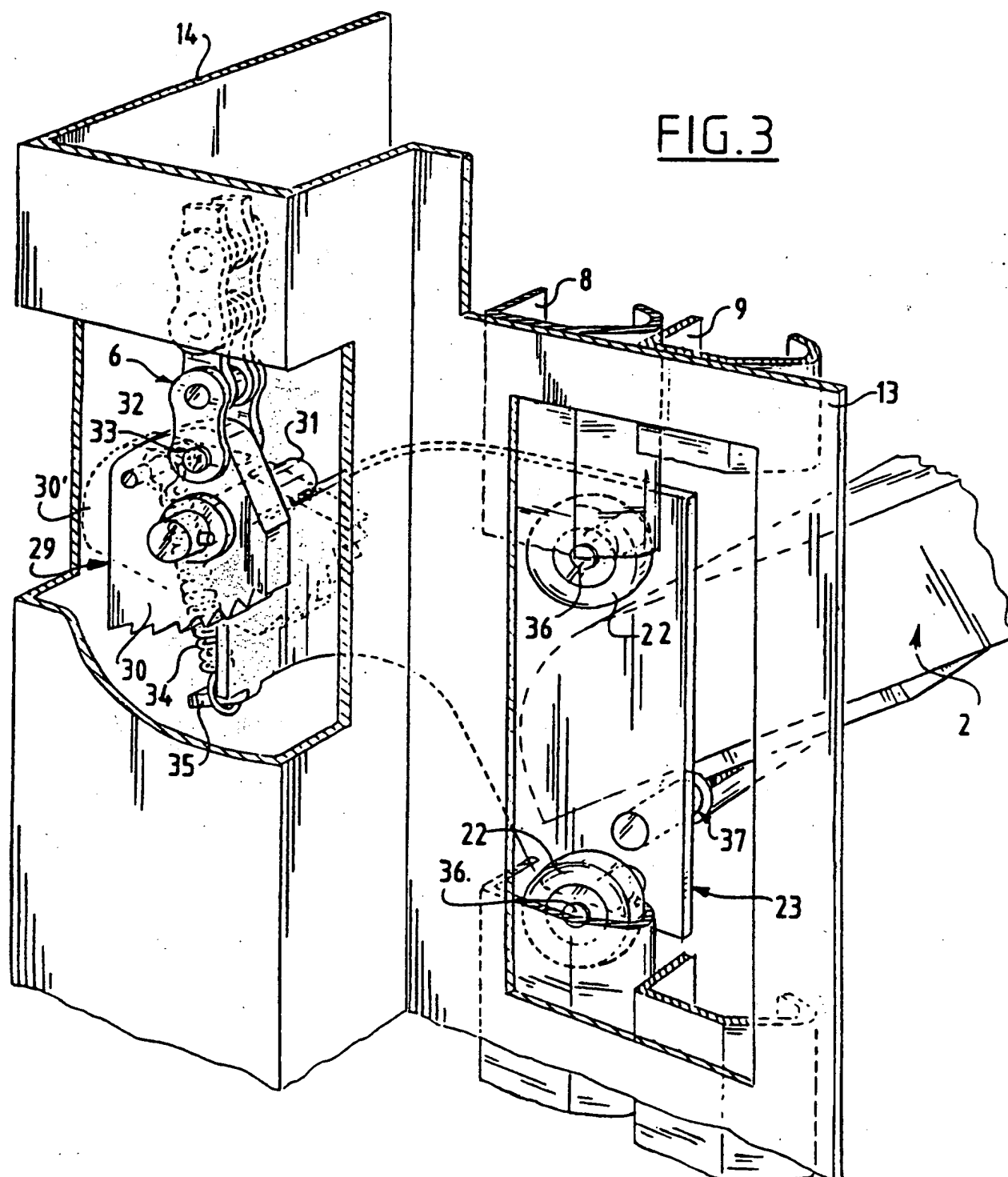


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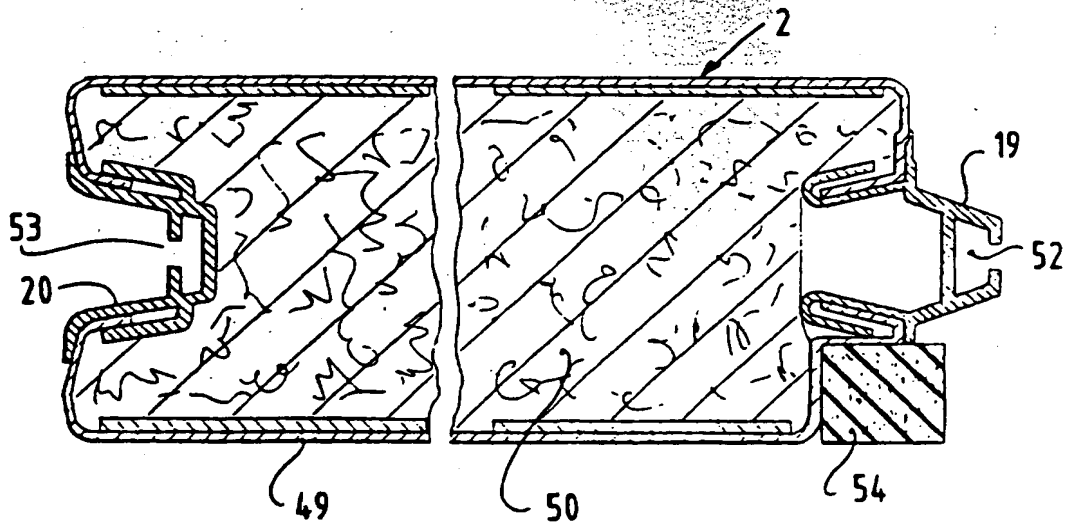
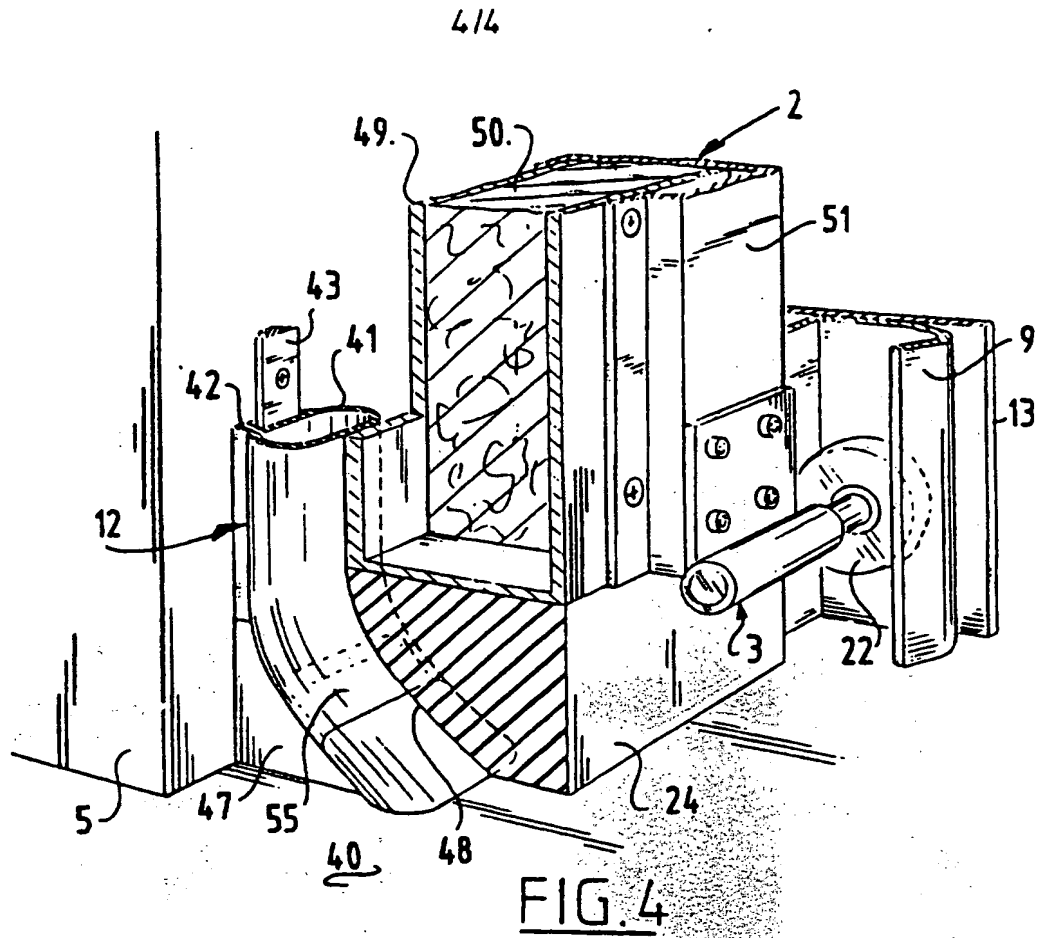


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FIG. 3



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# INTERNATIONAL SEARCH REPORT

International Application No

PCT/NL 95/00451

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 E05D15/26 E06B7/23 E06B9/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 E05D E06B F25D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,4 250 941 (MCNALLY JOHN P) 17 February 1981 see abstract; figures 1-4	1
A	US,A,3 516 471 (HARKINS ALLEN A ET AL) 23 June 1970	

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Date of mailing of the international search report

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Information on patent family members

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US-A-4250941	17-02-81	NONE	
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